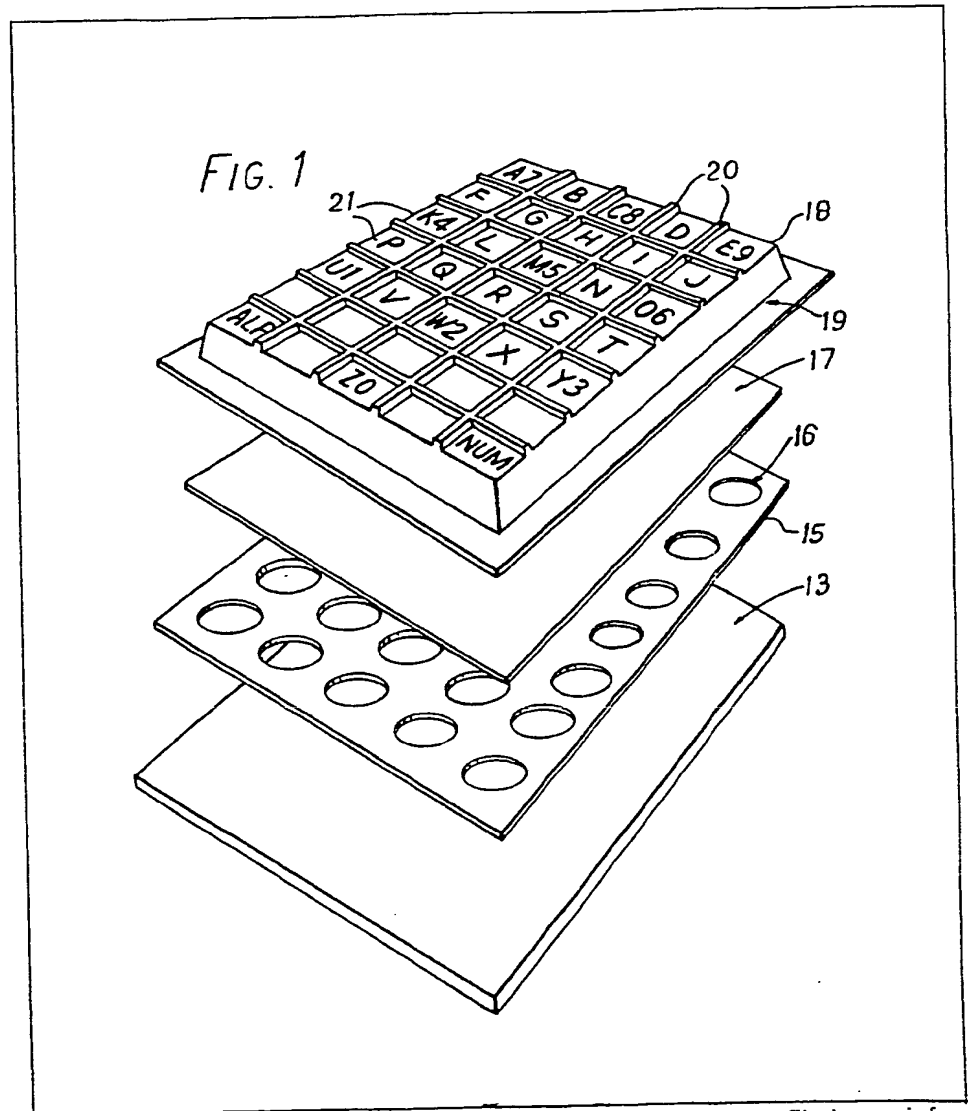


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(54) Keyboard

(57) A keyboard is protected against the environment by a moulded synthetic rubber sheet 18 which bears key areas 21 demarcated by ribs 20. The sheet is sealed on to a housing of the keyboard. Under each key area is a switch formed by two printed circuits 17 and 13 adapted to make localized contact through one of an array of aper-

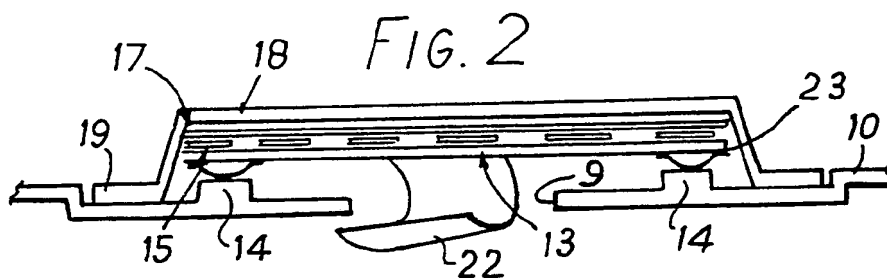
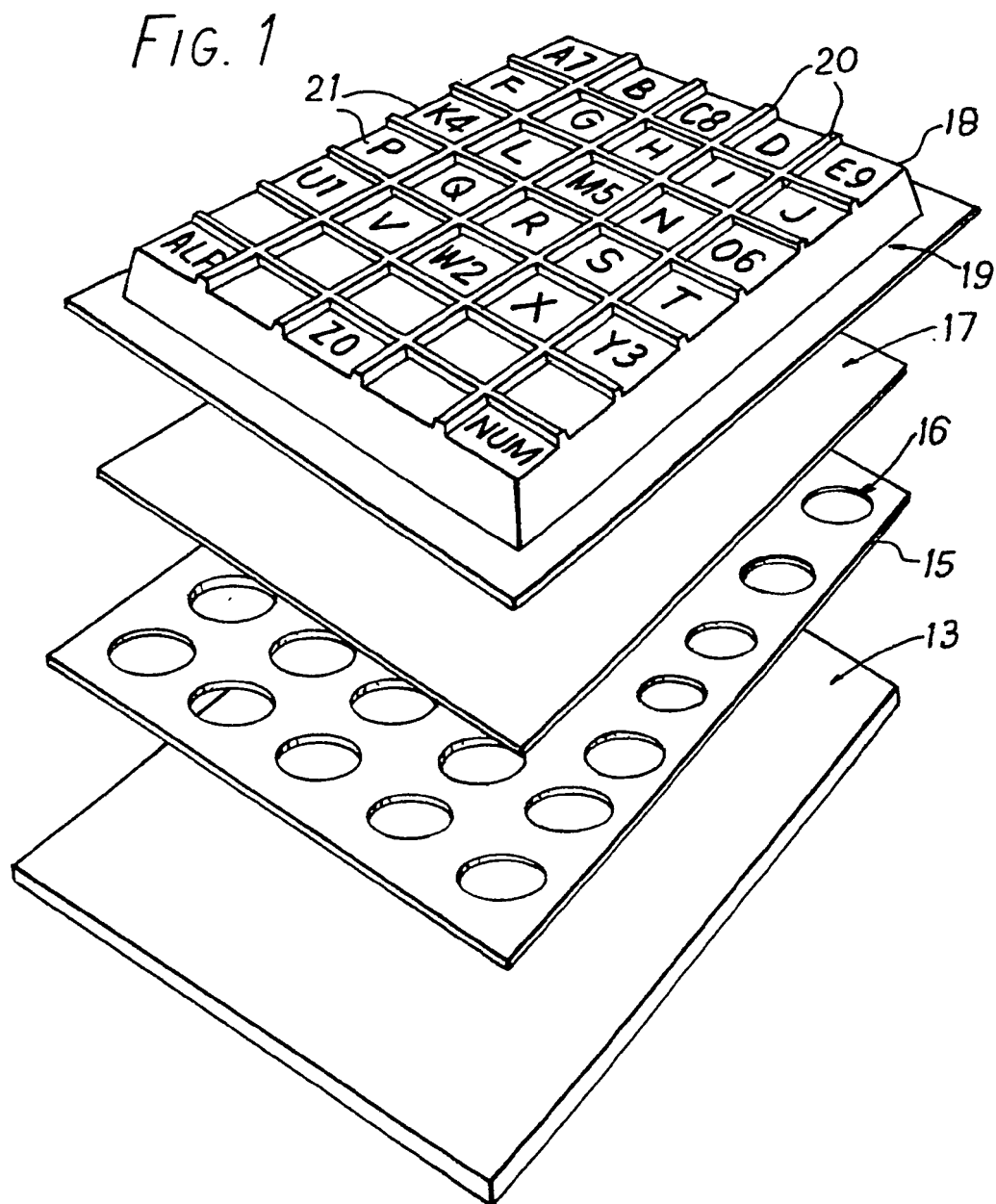
tures 16 in an insulating sheet 15. When a key area is pressed lightly, the corresponding symbol is displayed on an associated luminous display device but the data is not keyed into the working register. This occurs when heavier pressure operates a second switch such as a 'pancake' switch with snap action, of which there may be one under every key area or a smaller number acting collectively for all areas.



The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

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FIG. 3

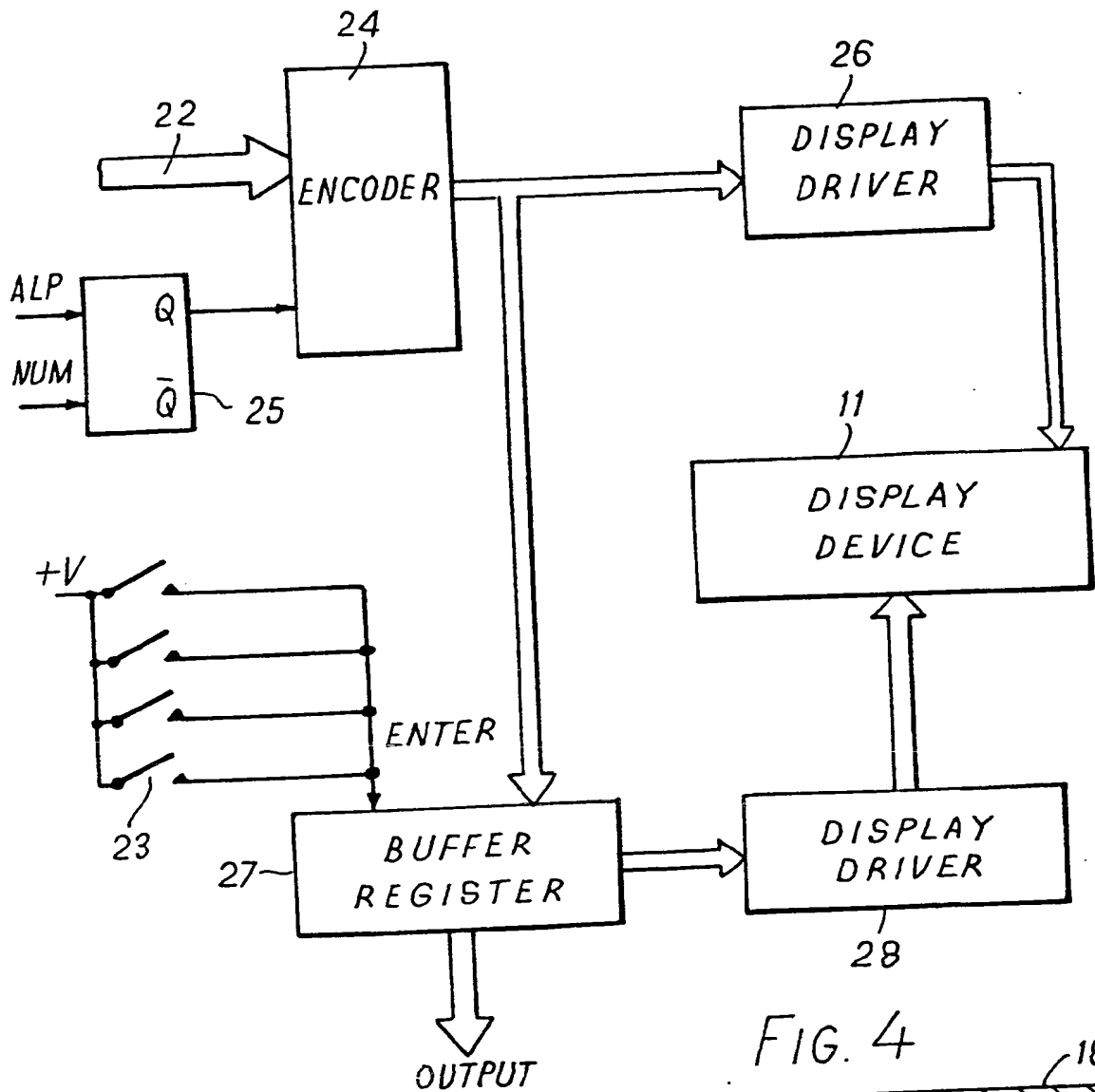
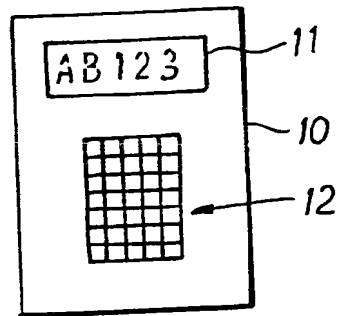
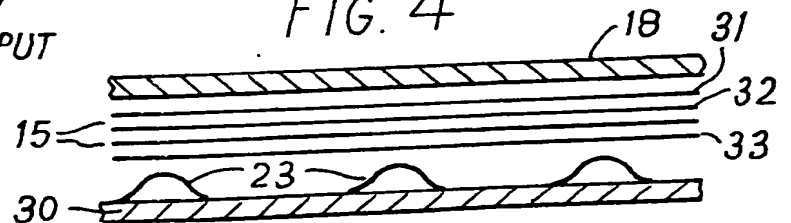


FIG. 4

FIG. 5



SPECIFICATION

An improved keyboard

- 5 The present invention relates to an improved keyboard which may be used to key symbols into apparatus under adverse conditions. The apparatus may be a data transmitter for example but the nature of the apparatus is not important to the invention.
- 10 The aforementioned adverse conditions may arise when the keyboard has to be used outdoors, possibly in the dark and possibly by an operator who is gloved on account of the weather. In these circumstances it is necessary to ensure that the keyboard is
- 15 adequately protected against the ingress of moisture and also that the operator can be sure that he is operating the correct keys.

According to the present invention in a first aspect there is provided a keyboard comprising a housing

20 with an opening closed by a flexible sheet, the housing and sheet together forming a watertight enclosure in which is arranged a plurality of individually operable switch devices, each operable by pressure on a corresponding area of the flexible

25 sheet.

- The switch devices are thus able to signal which area of the flexible sheet has been pressed and the various areas may be provided with symbol designations. The areas may also be demarcated by, for
- 30 example, a grid of ribs upstanding from the sheet or by making each area in the form of a boss on the sheet. The sheet may be moulded, with the ribs or bosses and symbol designations, from an elastomeric material.
- 35 The signals from the switches may be employed in various known ways. Each switch may have an individual conductor, all of the conductors being led in a cable out of the housing, through a watertight gland. On the other hand, there may be processing
- 40 circuits within the enclosure which perform a coding operation, e.g. coding the key signals into an ASCII or other code or coding signals on the basis of simultaneous operation of a plurality of keys. The coded signals, rather than the individual key signals,
- 45 are then conducted out of the enclosure.

The invention in the first aspect accordingly provides a keyboard which is suitable for use outdoors or in other adverse environments but it does not help the operator to be sure that he is

50 operating the correct keys.

- According to the invention in a second aspect, there is provided a keyboard comprising a plurality of first switch devices operable by a first pressure to generate corresponding signals, a display device
- 55 responsive to the signals to display a symbol indicating which first switch device has been operated, and at least one additional switch device arranged to operate when a greater pressure than the said first pressure is applied to one of the first switch
- 60 devices to provide an enabling signal, and a circuit arranged to accept signals from the first switch devices conditionally upon the presence of the enabling signal.

A symbol is then only effectively keyed when the

65 operator applies the greater pressure. Before he

does this he has an opportunity to review the symbol on the display device to check that it is correct. There may be an additional switch device for each first switch device, or there may be a small number of additional switch devices common to the first devices.

The invention will be described in more detail, by way of example, with reference to the accompanying drawings, in which:

- 75 *Figure 1* is an exploded perspective view of the main structural parts of a keyboard embodying the invention,

Figure 2 is a cross-section of the keyboard,

Figure 3 is a plan view of the keyboard,

- 80 *Figure 4* is a block circuit diagram, and

Figure 5 is a fragmentary sectional view of another keyboard embodying the invention.

The keyboard of Figures 1 to 3 comprises a housing 10 containing a display device 11 arranged

85 above a keyboard area 12. The display device can be any kind of device such as is used in instrumentation displays but is preferably a luminous display which can be read in the dark.

Under the keyboard area 12 the housing has an

90 opening 9 over which a rectangular printed circuit board 13 is supported at its corners on bosses 14. On top of the board 13 are a thin insulating sheet 15 with apertures 16 therethrough, and a thin conducting sheet 17. Over this whole structure is disposed a

95 flexible sheet 18 of elastomeric material with an integral flange 19. This flange is clamped against or bonded to the surface of the housing 10 so that the interior of the housing is a watertight enclosure.

The top surface of the sheet 18 is moulded with a

100 grid of ribs 20 demarcating key areas 21 marked with corresponding symbols. It will be seen that a ten key numeric keyboard is superimposed upon an alphabetic keyboard with selection therebetween by the keys ALP (habet) and NUM (eric). Dual function

105 keys with "shift" or function selection keys are so well known in various types of keyboard that this aspect of the illustrated embodiment will not be considered any further.

It will be seen that there is a 7 x 5 array of key areas

110 21; the apertures 16 are arranged in a corresponding array below the key areas and the board 13 bears on its top surface a printed circuit pattern (not shown) comprising a respective terminal area beneath each aperture 16. The circuit pattern connects the terminal

115 areas to a ribbon connector 22.

In between the board 13 and the bosses 14 are interposed switches 23 of the type known as "pancake" switches. These switches are normally open and require definite manual pressure to close; they

120 close with a sensible "click". When the user presses any key area 21 lightly, a corresponding first switch closes, i.e. the metal sheet is pressed through the corresponding aperture 16 into contact with the corresponding terminal area. Increased pressure on

125 the key area causes one or more of the switches 23 to close.

As shown in *Figure 4*, the ribbon connector 22 leads to an encoder 24 which encodes the key signals, in conjunction with a signal from a bistable

130 flip-flop 25, into say 5-bit signals. The state of the

flip-flop is selected by the ALP and NUM keys. The encoded signals are applied directly to a display driver 26 which controls say the extreme right display position of the display device 11.

- 5 The encoded signals are also applied to a multi-symbol buffer register 27 but are only entered therein in response to an ENTER signal which is provided when any of the switches 23 is closed. Conventional techniques are used to enter successive symbols into successive symbol locations in the register 27, e.g. as in calculators. The register 27 is connected to display device 28 which control the remaining display positions of the device 11. The register 27 also provides the means of communicating the output of the keyboard to further apparatus, such as a data transmitter.

In use, the operator presses a key area lightly and observes the corresponding symbol at the right hand end of the display 11. If the symbol is not the one intended, the operator moves his finger until he sees the correct symbol. In fact, symbols can be found without looking at the keyboard or even knowing its layout, by running a finger over the key areas with light pressure while looking at the display.

Once the correct symbol is seen, the operator gives a good push to close one or more of the switches 23. The ENTER signal causes the symbol code to enter the buffer register 27. The symbol is now also displayed at the corresponding location so that the operator knows that he has entered it. Operation of the keyboard is thus virtually fool-proof and it is suitable for use in adverse environmental and adverse working conditions.

35 Figure 5 illustrates an alternative construction in which the flexible sheet 18 is disposed above a base-plate 30 on which is mounted an array of snap action "pancake" switches 23, one under every key area as in a pocket calculator in which such switches are employed. However, as in Figure 4, all these switches are electrically in parallel.

In between the sheet 18 and the switches 23 are four thin sheets, namely from the top downwards:-

(a) An insulating film 31 with a metallized top surface. This provides electrostatic shielding, the metallization being connected to the keyboard casing 10 (Figure 1).

(b) A flexible printed circuit 32 with metallized first conductors on its underside.

50 (c) An apertured insulating film 15 (as in Figure 1).

(d) Another flexible printed circuit 33 with metallized second conductors on its underside.

The first conductors are simply row conductors and the second conductors are simply column conductors (or vice versa) and the encoder 24 operates in known way by sensing which row/column intersection has an electrical connection made by pressure on the key area above.

60 Many modifications are possible to the desired embodiment. The first switches may be individual switches, rather than being constructed on a printed circuit board. The switches 23 need not be one per key area or four in number and various constructions are feasible. For example contact strips could run

along edges of the board 13 in Figure 1 and contact fixed strips when sufficient pressure was applied to the board.

It may be preferable for the preliminary display of a symbol not to be at a special preview position but at the position where it will be displayed when entered and the logic of Figure 4 may be modified to achieve this result. It is merely necessary for the output of the driver 26 to be commutated to the true display position, which can be achieved by a switching arrangement controlled in sympathy with the known circuitry which selects the position in the buffer register 27 where the symbol will ultimately be entered. A symbol being previewed will disappear if pressure is removed before a switch 23 is closed but it will be entered and stay displayed once sufficient pressure has been applied to close a switch 23.

85 CLAIMS

1. A keyboard comprising a plurality of first switch devices operable by a first pressure to generate corresponding signals, a display device responsive to the signals to display a symbol indicating which first switch device has been operated, and at least one additional switch device arranged to operate when a greater pressure than the said first pressure is applied to one of the first switch devices to prove an enabling signal, and a circuit arranged to accept signals from the first switch devices conditionally upon the presence of the enabling signal.

2. A keyboard according to claim 1, wherein the first switch devices are flexible printed circuit switches and the or each additional switch device is a snap action switch.

3. A keyboard according to claim 2, wherein there is an additional switch device for every first switch device and all the additional switch devices are connected electrically in parallel.

4. A keyboard comprising a housing with an opening closed by a flexible sheet, the housing and sheet together forming a watertight enclosure in which is arranged a plurality of individually operable switch devices, each operable by pressure on a corresponding area of the flexible sheet.

5. A keyboard according to claim 4 wherein the said areas are demarcated by ribs upstanding from the sheet.

6. A keyboard substantially as hereinbefore described with reference and as illustrated in Figure 1 to 4 of the accompanying drawings or these Figures as modified by Figure 5 of the accompanying drawings.

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